into fragments which are our present system of planets. From the mathematical investigation on which this hypothesis is based, it appears that the fragments would each be comparable in mass with the original sun if the matter of the sun had been of approximately uniform density, but would be very small by comparison if the sun had been gaseous with high central condensation. The smallness of the masses of the planets in comparison with that of the sun must, therefore, be taken as indicating that the sun was in a gaseous state with high central condensation when the planets were born. The jets of matter thrown out would also be gaseous, but would rapidly cool in the process of ejection, and might soon liquefy or even solidify. It can be shown that the planets which would be formed out of the middle portion of such a jet ought to be much more massive than those formed near the ends, and this may possibly provide an explanation of the comparatively great masses of Jupiter and Saturn. We imagine that the planets at first described orbits under the combined gravitational action of the sun and the passing star by which the cataclysm was caused, but as this star receded they were left revolving, as at present, around the sun. During their earlier motion they may themselves have been broken up by the tidal action of one or both of the big masses present, and such a process may explain the origin of the satellites of the planets.

Such, in its main outlines, is the tidal theory of the genesis of the solar system. So far as can be seen, a vast amount of further mathematical research is needed before it can be either definitely accepted or finally condemned. For myself, I find it more acceptable than the rotational theory, or any other hypothesis so far offered, of the origin of the solar system. Time does not permit of a discussion of its difficulties, but I may perhaps conclude by stating what seem to me to be its main advantages over the rotational theory.

(i) It escapes the well-known criticism of the rotational theory that the present angular momentum of the solar system is too small to be compatible with a previous rotational break-up, and I do not know of any similar quantitative criticism which can be brought against the tidal theory.

(ii) The solar system is arranged with reference to two planes—the invariable plane of the system, which contains the orbits of the outer planets, and a second plane inclined at about 6° to the former plane, which contains the sun's equator and the orbit of Mercury. A system which had broken up by rotation alone ought to be arranged symmetrically about one plane—the original invariable plane of the system. On the tidal theory the two planes of the solar system are readily explained as being the plane in which the tide-raising star moved past the sun, and the original plane of the sun's rotation.

(iii) Theoretical investigations suggest that there is only one possible end for a rotating system, namely, a binary or multiple star of the type familiar to astronomers, and it is quite certain our system is not of this type. Similar investigations on tidal action suggest that the final end of a system broken up by a tidal cataclysm ought to show many of the features of our present solar system.

The Edinburgh Meeting of the British Association.

By PROF. J. H. ASHWORTH, F.R.S.

LOCAL ARRANGEMENTS.

THE British Association meeting to be held during the week September 7–14 is the fifth meeting of the Association to be held in Edinburgh, the previous meetings having been in 1834, 1850, 1871, and 1892. The last of these, under the presidency of a distinguished son of Edinburgh—Sir Archibald Geikie—was a memorable and successful meeting, and the citizens of Edinburgh are anxious to make the forthcoming meeting no less notable and successful.

As at the last Edinburgh meeting, the reception room, the headquarters of the Association, and the bureau of information will, by permission of H.M. Office of Works, be the Parliament Hall, in which the Scottish Parliament met until the Treaty of Union in 1707. One of the courts adjacent to the hall will be used for the meetings of council and of other administrative committees, and by permission of the Faculty of Advocates rooms in the advocates' library, which is adjacent to Parliament Hall, have been provided for the use of the president and general officers, and the advocates' writing-room has been placed at the disposal of members. The attention of members is directed to the rule prohibiting smoking in any part of the library and in Parliament Hall; a smoking-room is provided near the reception room. The usual postal (including telegraphic) facilities will be provided in the post office at the entrance to the reception room.

The sectional meetings will be held in the lecture rooms of the University. Six of the sections will meet in the Old College, two in the adjacent departments of natural philosophy and engineering, three sections and the conference of delegates in the University New Buildings (the medical school of the University), and the remaining two in the department of agriculture and forestry, which is within four minutes' walk of the University New Buildings and of the Old College. In connection with several of the sectional meetings, laboratory accommodation will be available for apparatus and specimens which members may desire to exhibit to illustrate their communications to the sections.

Writing-rooms will be provided in the University and in the Unions. The University library in the Old College is to be open so that members may consult books and the principal literary and scientific journals. The Upper Library contains many objects of literary and scientific interest, including Charles Darwin's class-cards for the lectures which he attended in the University in the years 1825–26, and will be available as a withdrawing-room and additional writing-room. At the Royal Society of Edinburgh, 22 George Street, members may see the principal scientific journals and consult books in the library.

The inaugural meeting and the evening discourses will take place in the Usher Hall, which is an ideal hall for the purpose and has excellent acoustic properties. The hall has spacious corridors, foyers, and cloak-rooms; its interior is well proportioned, and as the grand circle and the gallery above it are constructed on the cantilever principle there are no pillars to obstruct the view of any member of the audience. In this hall also will be given three of the public lectures to citizens. Sir Oliver Lodge will give the opening lecture on "Speech through the Ether, or the Scientific Principles Underlying Wireless Telephony"; Prof. Dendy will lecture on "The Stream of Life"; and Prof. H. J. Fleure on "Countries as Personalities." A special lecture, arranged in collaboration with Section M (Agriculture), for agriculturists will be given in the Natural History Theatre in the Old College of the University on the afternoon of market day (Wednesday, September 7) by Dr. E. J. Russell on "Science and Crop Production."

The Lord Provost, magistrates, and council of the city will give a reception in the Royal Scottish Museum on the Thursday evening; there will be a special graduation ceremonial in the M'Ewan Hall on the Tuesday afternoon, and a garden party immediately afterwards, which the local committee hopes to give in the Zoological Park.

The handbook is not quite on traditional lines; it is not an account of the history, topography, and organisation of the city—this information is accessible elsewhere—but will give an account of the place of Edinburgh in scientific progress. Owing to the present high cost of printing, the book must be kept within the modest limits of about 230 pages, but it is hoped that the authors who are collaborating in its production will be able to give within this compass an adequate account of the main lines in the advancement of science which have been especially associated with Edinburgh.

In order to give members an opportunity of visiting the more important places of historical and general interest round Edinburgh, arrangements are being made for excursions on the Saturday (*a*) to Loch Lomond, the Trossachs, and Stirling, (*b*) to Melrose Abbey and the Scott country, and (*c*) by river to Alloa and Stirling. Shorter excursions have been planned for other days. One of these is to H.M. Dockyard, Rosyth, by kind permission of Admiral Sir Herbert Heath; another is to Dunfermline, where the party will not only be able to inspect the historical abbey and church, but also those interested in sociology will have an opportunity of seeing the work of the Carnegie trustees; and another is to Linlithgow, where, in addition to historical interests, the party will be able to comprehend, from a commanding point of view, the manner in which the Forth valley has been eroded. Other excursions will be arranged to Swanston (the former home of Robert Louis Stevenson) and Craigmillar Castle, and to the Castle and Chapel of Roslin and to Hawthornden. Those interested in the architecture and picture galleries of the noble houses of Scotland will enjoy the excursion to Dalkeith Palace, the residence of the Duke of Buccleuch, and to the Marquis of Lothian's seat at Newbattle Abbey.

Edinburgh itself has not been forgotten in these arrangements; small parties will be conducted over the "Old Town," especially the "Royal Mile" from the Castle to Holyrood, and the member who avails himself of this opportunity will visit, under the guidance of Prof. Baldwin Brown, Dr. John Harrison, and other experts, the scenes of many of the most moving events in Scottish history.

The city and the surrounding country present many features of interest to the geologist, the biologist, the engineer, the geographer, and the student of the growth of cities. Sectional excursions to the chief points have been planned.

It has often been stated that Edinburgh is not an industrial or commercial city, probably because the reputation which it has enjoyed in other respects has overshadowed this aspect of its activities. In point of fact, however, banking, insurance, and financial interests are strongly represented, and the city has important industries. It has long been celebrated for book and map production, and among other industries are brewing and distilling, shipbuilding, engineering, rubber and chemical works. Arrangements have been made for the sections concerned to visit works representative of these industries.

The first list of hotels and lodgings is now ready, and can be obtained either from the London office, or from the Local Secretaries, The University, Edinburgh. Members should bear in mind that September is a busy month for ordinary tourist traffic in Edinburgh, and that they should therefore make their arrangements early. Some accommodation in hostels, at moderate charges, has been placed at the disposal of the local executive committee. Ladies and gentlemen desiring such accommodation should address their applications to the local secretaries direct before the end of July, by which time it is expected that the available places will be allotted. Preference will be given to scientific workers.

Luncheon and tea will be obtainable at moderate charges in the University Union and the University Women's Union, both of which are adjacent to the sectional meeting-rooms. Gentlemen who are members of the Association will be honorary members of the Union for the week, and ladies who are members will be honorary members of the Women's Union. In each case the honorary members will have the usual privileges, and may introduce one or two guests—ladies or gentlemen.

For the convenience of members arriving on Wednesday evening, September 7, who will have only a short time at their disposal between the time of their arrival and the inaugural meeting, arrangements have been made with the station-masters at the Caledonian and Waverley Stations to establish inquiry offices of the Association at which membership tickets will be issued. These offices will be opened at 5.30 p.m. for about an hour and a half, but members who anticipate arriving in Edinburgh after 5 p.m. would do well to obtain their tickets by post beforehand so as to avoid any congestion at these temporary offices.

Annual Visitation of the National Physical Laboratory.

THE annual visit to the National Physical Laboratory of the members of the General Board took place on June 28. A large number of guests were present, and were received by Prof. C. S. Sherrington, president of the Royal Society, the chairman of the General Board, and by the director of the laboratory, Sir Joseph Petavel.

An interesting ceremony preceded the visit, when a bas-relief in bronze of the late director, Sir Richard Glazebrook, was presented to the laboratory. The presentation was made by Sir Joseph Thomson, Master of Trinity College, Cambridge, and received on behalf of the laboratory by Prof. Sherrington. The bas-relief is the gift of a large number of friends of the late director, including many past and present members of the General Board.

It is now more than eighteen months since Sir Richard was succeeded by Sir Joseph Petavel, who has carried on very actively the work of his predecessor. Some buildings planned in 1918 are still in process of erection at Teddington, and the work of the laboratory continues to increase in magnitude and importance. The Admiralty has erected a research laboratory within the grounds of the National Physical Laboratory, so that much of its special work may be carried on in close co-operation with it.

As on previous occasions of this kind, the laboratory was thrown open to the visitors, who were given an opportunity of seeing the work that is at present being conducted in the various departments.

A wind tunnel of cross-sectional area 7 ft. by 14 ft. has been completed during the course of the current year, and affords a valuable addition to the equipment of the aerodynamics department. In it a new method for the measurement of rotary derivatives on an aeroplane was demonstrated. Demonstrations in the other tunnels included the measurement of the thrust and torque on an air-screw working in front of a streamline body with the simultaneous measurement of the drag on the body; pressure plotting on an airship hull which was carried out by means of a number of fine steel tubes run longitudinally along the hull in grooves and made flush with wax; and the measurement of lift, drag, and pitching moment on a model aerofoil supported on wires and hung from balances on the roof of the tunnel. Several complete models of aeroplanes were also exhibited.

The engineering department exhibited a machine presented to the laboratory by Mr. C. E. Stromeyer for the rapid determination of the fatigue ranges of materials under reversals of shear-stresses. Forced torsional vibrations are given to the specimen under test by means of a rocking arm and flywheel the mass of which can be adjusted. The specimen acts as an elastic constraint between the rocking arm and the flywheel. The usual method of finding the limiting range of stress by endurance tests requires six specimens, and, with the machine running continuously, occupies a week. By the new method the limiting range of stress can be found on a single specimen by two independent means at the same time, and the total time taken for the test varies from five minutes to a quarter of an hour.

In order to investigate the distribution of the air currents produced by the present system of ventilation in the debating chamber of the House of Commons, a wood model (one-eighth full size) has been constructed. Air is supplied to this through ducts of the existing pattern from a fan, the strength and direction of the air currents being investigated by air-speed meters and smoke bands.

An experimental range has been constructed for the study of the motion of 1-in. projectiles in flight. The range is being fitted to carry this out by a series of "jump" cards, and also photographically by the spark method of Prof. Boys.

Other exhibits in this department were the following: Apparatus for studying the effect of pressure and temperature on the production of detonation in a closed explosion vessel; apparatus by means of which the temperature of the lubricant, the load on the bearing, and the speed of the journal can be varied in order to obtain the coefficient of friction of lubricants under varying conditions; apparatus for determining the distribution of frictional resistance over thin plates; and machines for various tension and compression tests.

A new apparatus for the autographic determination of changes in the electrical resistance of alloys with varying temperatures up to and beyond the melting point was exhibited in the metallurgy department. A Morgan electric melting furnace, in which a clay-lined graphitic crucible acted simultaneously as the metal container and heating element, was shown in operation. Demonstrations were given in the experimental rolling-mill, illustrating the effect on the rolling properties of certain non-ferrous alloys of unsuitable mechanical and thermal treatment prior to the rolling operation.